

NAVAL WAR COLLEGE
Newport, R.I.

A THEATER-LEVEL INTEGRATED SENSOR-TO-SHOOTER CAPABILITY AND ITS
OPERATIONAL IMPLICATIONS

by

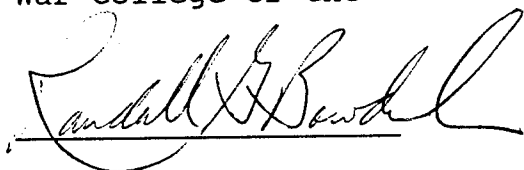
Randall G. Bowdish

Lieutenant Commander, U.S. Navy

A paper submitted to the Faculty of the Naval War College in partial satisfaction of the requirements of the Joint Maritime Operations Department.

The contents of this paper reflect my own personal views and are not necessarily endorsed by the Naval War College or the Department of the Navy.

Signature:



08 March 1995

Paper directed by Captain D. Watson
Chairman, Joint Military Operations Department

DTIC QUALITY INSPECTED 5

19950417 008

ABSTRACT

Current military technological trends clearly point to an unprecedented theater-level integrated sensor-to-shooter (TLISTS) capability that will soon seamlessly bind all branches of the Armed Forces, achieving a synergistic capability greater than the sum of their parts. This TLISTS capability is described, followed by its operational implications in the areas of operational reconnaissance and intelligence, operational fires, tempo and synchronization. Command and control (C2) and doctrinal issues are also explored. The operational implications suggest that a TLISTS capability will enhance the operational commander's ability to craft operational art.

Accession For	
FTIS GRA&I	<input checked="checked" type="checkbox"/>
DTIC TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
Justification	
By	
Distribution/	
Availability Codes	
Dist	Avail and/or Special
A-1	

A THEATER-LEVEL INTEGRATED SENSOR-TO-SHOOTER CAPABILITY AND ITS OPERATIONAL IMPLICATIONS

"Advances in technology are likely to continue to increase the tempo, lethality and depth of warfare. Joint doctrine should be flexible enough to recognize the impact of emerging technologies and integrate emerging advances that may provide the US Armed Forces with a decisive advantage." (Joint Pub 3-0, Doctrine For Joint Operations)

A Revolution in Military Affairs (RMA) is occurring within the U.S. Armed Forces that may provide them with a decisive warfighting advantage and ultimately change the face of modern conventional warfare. U.S. combat power displayed during "Desert Storm" may have been merely a precursor to a generational leap in military conventional capability unseen since the German "blitzkrieg" of World War II.

This paper begins with a description of the "Theater-Level Integrated Sensor-to-Shooter" capability emerging from the current RMA followed by discussion of its potential operational implications.

Theater-Level Integrated Sensor-to-Shooter Capability

Current military technological trends clearly point to an unprecedented theater-level integrated sensor-to-shooter (TLISTS) capability that will soon seamlessly bind all branches of the Armed Forces, achieving a synergistic capability greater than the sum of their parts.¹ The U.S. military will be even more capable of fighting as a total force, integrated and linked horizontally and vertically in

the real-time battlespace. This synergistic, linked TLISTS capability, depicted by the shaded balloons in Figure 1, is an outgrowth of the sensor-to-shooter (STS) process, shown as the rectangular blocks in Figure 1. The STS process enables the TLISTS capability, with the differentiation between the two being hardware used in the latter (such as sensors, noncooperative IFF and Precision Guided Munitions (PGMs)).

The TLISTS capability of Figure 1 begins with organic, computer resident Planning, Optimization, and Assignment functionality in the hands of the theater commander. The theater commander and staff will have at their disposal

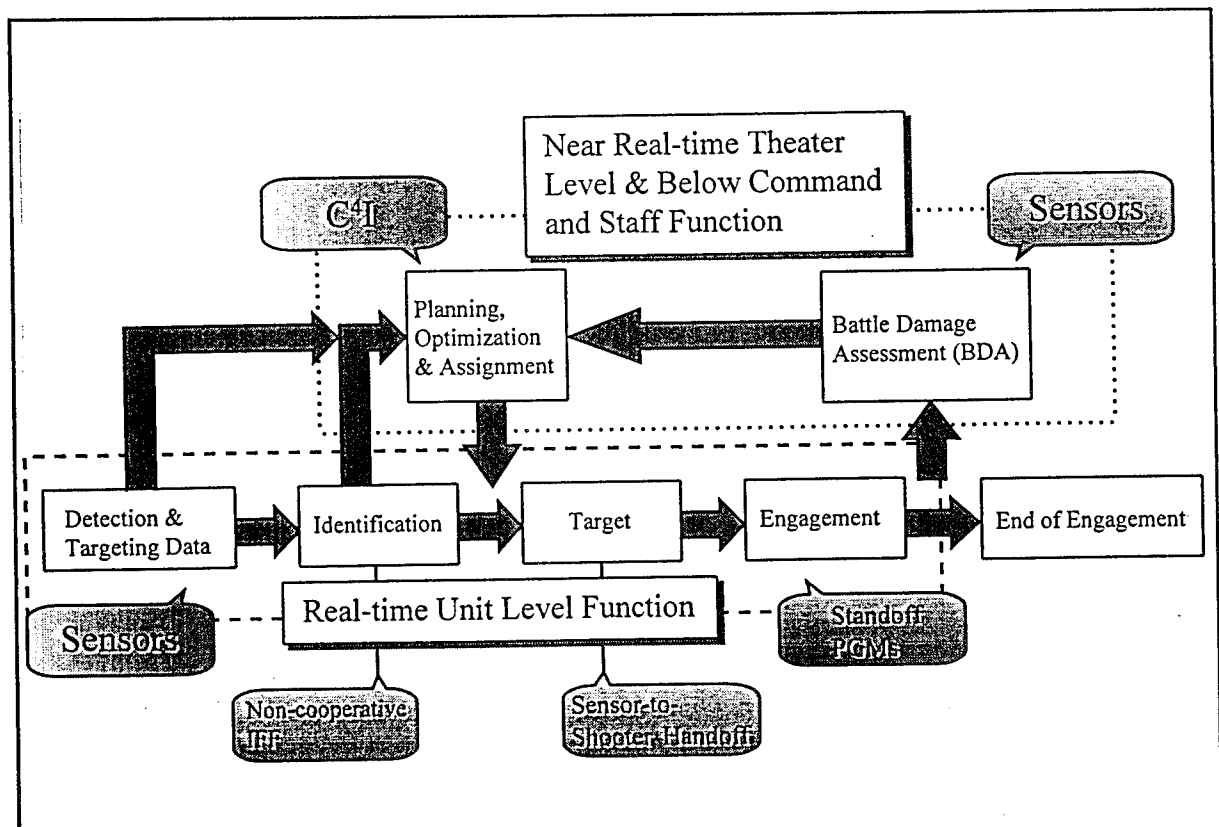


Figure 1 The TLISTS capability and STS process.

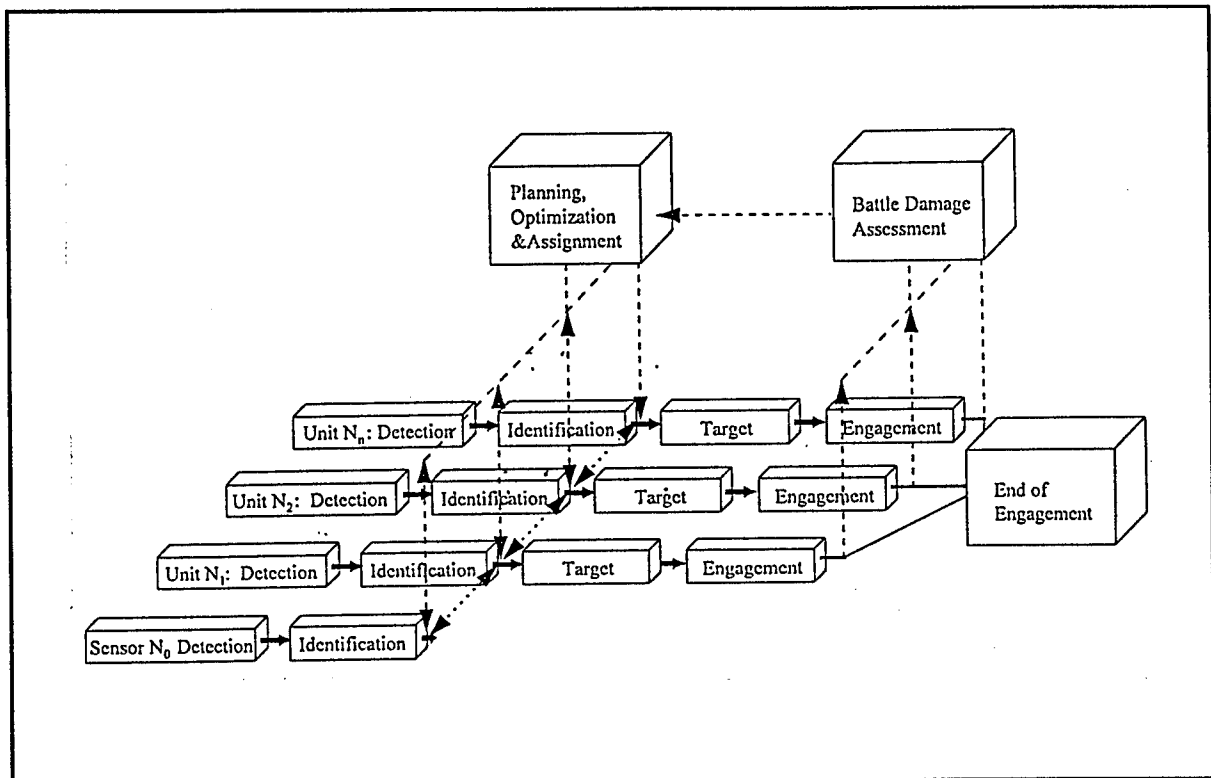


Figure 2 The STS process in depth and linked.

computer resources sophisticated enough to not only handle the tremendous amount of information needed in planning a campaign, but also capable of generating optimum solution recommendations, which can be transmitted instantaneously to the battleforce at the push of a button.

Moving to the front-end, we turn to sensor detection. The integration of Global Positioning System based sensors into the STS process provides a simultaneous detection and targeting data capability within the TLISTS which can be transmitted throughout the battleforce. Electromagnetic spectrum dominance will be critical to establishing and maintaining the TLISTS linkage between friendly forces, shown in Figure 2. The goal will be to construct a distributed

network of sensors such that the enemy is left with no place to hide in the battlespace.

Another key to achieving a TLISTS capability will be the ability to identify friends, foes, neutrals, and noncombatants. The avoidance of fratricide, a historic yet somewhat elusive goal of commanders, has been the impetus behind the development of Identification Friend or Foe (IFF) systems. A non-cooperative IFF system (under development) will passively recognize platforms in the real-time based upon their inherent characteristics. It will not only help to avoid fratricide, but will also identify hostiles without their knowledge. Until a noncooperative IFF capability is developed, commanders will instead rely upon an integrated, correlated and fused C⁴I picture. Cooperative IFF systems, coupled with an enemy undisciplined in radiofrequency management, will provide the commander with a somewhat more opaque picture of the battlespace. This relative opaqueness is due to a cooperative IFF system's inability to discriminate between hostiles, neutrals and noncombatants. Subsequently, a fused C⁴I picture constitutes only an interim step in the progression towards a full TLISTS capability.

The next part of the STS process is targeting, with the goal of a TLISTS capability being to conduct real-time handoffs between sensors and shooters across the battleforce. Shooters will not have to rely upon their own active sensors for targeting. This capability is desirable because the use of

organic active sensors can provide counter-targeting information to the enemy. With a TLISTS capability, a firing unit will be able to shoot from another friendly sensor's targeting data--located beyond the reach of the enemy--which will be automatically gated and constantly updated during the engagement.

Standoff PGMs will provide a devastating first wave of the engagement. Results of the engagement will be linked in real-time back to the battleforce via the aforementioned distributed network of sensors for Battle Damage Assessment (BDA).

The commander will be able to quickly process BDA data in the near real-time with the assistance of pattern recognition software resident in sophisticated, organic combat computers. Optimized re-attack recommendations will be generated which will include optimized firing solutions for own force units against a prioritized list of remaining threats.

Operational Implications

A TLISTS capability offers an operational commander powerful new tools for crafting operational art. The theater commander will be able to directly shape the battlefield like never before. The operational commander will have a system capable of supporting near real-time operational reconnaissance and intelligence, and unprecedented operational fires, tempo and synchronization. But, a TLISTS capability may also come with a potentially severe price in the

functional area of command and control. And what of doctrine? Will joint doctrine need to be rewritten to accommodate a TLISTS capability? These operational issues are addressed in the following sections.

> Operational Reconnaissance and Intelligence

Operational Reconnaissance and Intelligence concentrates on "the collection, identification, location, and analysis of strategic and operational centers of gravity that, if successfully attacked, will achieve the assigned strategic aims and significant factors affecting operations."² It enters the STS process via the Detection and Targeting Data, Identification and Targeting blocks. However, it is unique in that it is transmitted to the Planning, Optimization and Assignment function pre-filtered with a focus on strategic and operational centers of gravity.

A TLISTS capability enables Operational Reconnaissance and Intelligence to be linked horizontally and vertically throughout the battleforce, allowing the operational commander to share a common picture of the battlefield with subordinate commanders.³ Alternately, subordinate commanders will be able to digitize and uplink the tactical battlefield picture to give the operational commander a comprehensive view of the theater from the tactical perspective--supplying the operational commander with a "directed telescope."⁴

Inherent in this approach is the potential for the operational commander and subordinate commanders to be

overwhelmed with extraneous intelligence. To guard against this and provide them with only the information they need, "Real-Time Battlespace Information" will consist of three elements--Preplanned Essential Elements of Information, Over the Air Updating, and Warrior Pull on Demand.⁵ "Real-Time Battlespace Information," of which Operational Reconnaissance and Intelligence is a big part, translates into the subordinate commander's ability to see only needed information, whether it be the disposition of both friendly and hostile forces within the local area of interest or across the entire theater. This will act to synergistically increase effectiveness across the force by enhancing synchronization and sequencing of operational maneuver and fires. Subordinate units will know exactly where they are, where they are supposed to be, and where the enemy is--resulting in complete situational awareness. Because of this, subordinate commanders will be better able to execute and coordinate their missions in accordance with the operational commander's plan.

The capability described above will place a great deal of pressure on the intelligence community to provide an unprecedented level of intelligence support for joint operations. "In short, operational intelligence must be high-quality intelligence. It must be timely, objective, usable, ready, complete, accurate, and relevant."⁶ In view of declining budgets and the intelligence communities transition from a cold war structure, it remains to be seen whether too

much will be asked of them. Nonetheless, the trend in Operational Reconnaissance and Intelligence is clearly towards providing this type of capability.

> Operational Fires

"Operational fires are the application of lethal and nonlethal firepower to achieve a decisive impact on the conduct of a major operation or campaign."⁷ The operational commander uses operational fires to shape the battlefield, support friendly operational maneuver and interdict the enemy. Up until recent times, operational fires were effectively limited to delivery by air assets (ICBMs not included). The introduction of long range, standoff PGMS (an integral TLISTS ingredient), into land and maritime forces, however, has distributed this capability across the battleforce. Subsequently, not only does this result in more options for the operational commander, but also improves operational synchronization--the ability to simultaneously hit dispersed operational objectives throughout the battlespace--from the land, sea and air.

TLISTS C⁴I computing power will assist the operational commander in planning operational fires by optimizing weapon allocations against desired targets, taking into account such factors as threat, priority, time to target, time on target, geometry, geography, etc. The operational commander will be presented operational fire recommendations based upon the desired end state. This results in the operational commander

having more power at his direct disposal with which to shape the theater.

An issue that will require considerable reflection on the part of the operational commander will be the allocation of standoff weapons for operational fires versus what remains for organic use by subordinate commanders. Allocation considerations will be scenario dependent. Although optimization subroutines will assist the operational commander in making allocation decisions, it will remain an issue deeply rooted in operational art.

Another critical consideration for the operational commander trying to minimize casualties will be the increased attractiveness of using unmanned operational fire weapons. The potential loss of life in any conflict is always of the utmost concern to a commander and bears with it intense consideration on how that loss might be prevented. Human lives are priceless. Tomahawk missiles, on the other hand, are quantifiable. Coupling an American public's expectation of fewer casualties with a commander's similar desire, it is anticipated that the use of unmanned operational fire weapons will only increase in future conflicts.

> Operational Tempo

The Army's FM 100-5, Operations describes tempo as follows:

"Tempo is the rate of speed of military action; controlling or altering that rate is essential for maintaining the initiative.... Commanders seek a tempo that maintains relentless pressure on the enemy to

prevent him from recovering from the shock and effects of the attack."⁸

Operational tempo depends to a large extent on the speed of the decision-making cycle. Since tempo is relative, having a decision-making cycle faster than the enemy enables a faster tempo. The potential for a much faster decision-making cycle is resident in a TLISTS capability due to its maximization of automation, data linkage and quicker hardware. For example, a noncooperative IFF capability is inherently faster in that no further action is necessary to differentiate hostiles from noncombatants.

Operational tempo is also increased by conducting simultaneous tactical missions rather than phased or sequenced ones. This relates in large measure to operational synchronization.

While a TLISTS capability will provide the tools with which to increase operational tempo, ultimately, operational tempo will depend upon the individual decision-making ability of the commander. History is replete with examples of senior military leaders slow or unable to make a decision. There is no reason to believe the future will be any different. A TLISTS capability will not solve this problem.

> Operational Synchronization

Operational synchronization consists of both the synchronization of forces and the synchronization of functions.⁹ The operational commander seeks to apply overwhelming joint force at the decisive point through the

synchronization of forces. On the other hand, the synchronization of such functions as Command and Control, Intelligence, Logistics, Fires, Maneuver and Movement, and Protection helps to achieve unity of effort.

A TLISTS capability enhances operational synchronization, particularly after the first engagement. Field Marshall Helmuth von Moltke ("The Elder") once said "no plan survives contact with the enemy."¹⁰ The fog and friction of war, not to mention the independent will of the enemy, act to disrupt situational awareness, and necessitate modifications to even the most carefully laid plans. A TLISTS capability provides joint situational awareness throughout the operational chain of command, across the timeline of the operation or campaign. Joint forces are able to seize and maintain the initiative by coupling situational awareness with a faster decision-making cycle and operational tempo.

A TLISTS capability enables functional synchronization by elevating subordinate command functional elements to the Near Real-time Theater Level and Below Command and Staff Function level (see Figure 1) where integration occurs. Doctrine and the organization of functional components play a more significant role in achieving functional synchronization. However, a TLISTS capability does act to enable and enhance it.

> Command and Control

Armed Forces Staff College Pub 2, Service Warfighting Philosophy and Synchronization of Joint Forces, describes operational command and control as:

"... the exercise of authority and direction by a properly designated commander over assigned forces in the accomplishment of a mission.... Command and control is the glue that binds the other operational systems together, creating a synergistic effect. Command allows leaders to impart their vision to subordinates, fix responsibilities, and empower subordinates with freedom of action. Control enables leaders to establish limits, focus effort, and give structure."¹¹

Commanders need to digest huge amounts of information, from the disposition of friendly and enemy forces to the weather, in order to establish the commander's intent. Martin Van Creveld, in his book Command in War, describes this as a quest for certainty which, no matter how sophisticated the command and control system, will never be achieved.¹² The fundamental nature of war coupled with the paradoxical relationship between the need for timely information vice needing more time to process ever increasing amounts of relevant information act in concert to ensure some degree of uncertainty.

Yet, uncertainty acts against the enemy as well as own forces. Uncertainty, like tempo, is relative. If one side is able to dissipate the fog of war to a mere mist, a decisive advantage can be achieved. Can a TLISTS capability alone provide this for the operational commander? It depends. In a "Desert Storm" type of conflict where one side had the

advantage of high-tech sensors capable of seeing the entire battlefield, the operational commander held a tremendous edge in relative certainty. In a Viet Nam or North Korea type of scenario, however, weather and terrain might seriously reduce and possibly even negate this advantage.

Van Crevald also suggests that the structure of command can be decisive in coping with uncertainty, and offers five organizational observations, which all interact:

"(a) ... decision thresholds ... fixed as far down the hierarchy as possible, ... freedom of action at the bottom of the military structure; (b) ...an organization that will make such low-decision thresholds possible by providing self-contained units at a fairly low level; (c) ... a regular reporting and information transmission system working from both the top down and from the bottom up; (d) ...a[n] ... active search of information by headquarters ... to supplement the information sent to it ... (e) ... an informal, as well as formal, network of communication ..."¹³

While a TLISTS capability will act to enable items (c) and (d) above, it will have no bearing on the others. This is due to their being based on an organizational approach to dealing with uncertainty, which ultimately boils down to a choice between centralization or decentralization.¹⁴

Centralization results in greater certainty at the top, at the expense of uncertainty at the bottom. Decentralization, on the other hand, results in greater certainty at the bottom and uncertainty at the top.

A critical operational implication of a TLISTS capability is that it will enable a greater degree of centralization by virtue of its information processing power. This represents a

tremendous advantage for senior civilian and military leadership engaged in extremely delicate Military-Operations-Other-Than-War where tight military control is required. But, it also carries with it a grave risk at all levels of command up to and including the National Command Authority (NCA). The potential for upper echelons of command to micromanage the actions of subordinates will be real and tempting. One can envision a scenario in the not too far off future where a Generation X NCA directs combat operations from a video display, then looks for the reset button when things go deadly wrong. A more likely scenario is a snowballing effect from innocent requests for information--to obtain certainty--resulting in the final usurpation of subordinate commanders authority. This is not a new problem, however, and is one that senior leadership continues to wrestle with.

> Doctrine

The question remains as to whether or not joint doctrine will need to be rewritten given the operational implications of a TLISTS capability. The opening quote from Joint Pub 3-0 states that joint doctrine was written with enough flexibility to incorporate technological advances. Indeed, this is the case for the TLISTS capability. Not only does joint doctrine accommodate a TLISTS capability, it embraces it. Fundamental operational art concepts such as those discussed above are all enhanced by a TLISTS capability. The bottom line is that joint doctrine is fine the way it is.

Conclusion

A TLISTS capability constitutes the technological underpinnings of an RMA. Stacking up a U.S. force (equipped with a TLISTS capability) against an equally numbered and equipped opponent (*sans* TLISTS capability) is a litmus test which, based upon intuition, would seem to favor the U.S. force in a decisive fashion. Wargaming this capability will help to resolve whether this is indeed a revolutionary leap or just another small step in the evolution of warfare. Although there are potential pitfalls associated with a TLISTS capability, the majority of the operational implications suggest that a TLISTS capability will be a powerful tool which will enhance the operational commander's ability to shape the battlefield and conduct operational art.

NOTES

1. For an in-depth development of the TLISTS capability, see Randall G. Bowdish, The Revolution in Military Affairs: Giving Birth to the Sixth Generation, Scheduled for publication in the Summer 1995 edition of Parameters, U.S. Army War College, Carlisle Barracks, PA.
2. Armed Forces Staff College, AFSC Pub 2, Service Warfighting Philosophy and Synchronization of Joint Forces, August 1992, p. II-5-B-1.
3. Command, Control, Communications, and Computer Systems, J-6, The Joint Staff, "Committed, Focused, and Needed" C⁴I for the Warrior, (Washington: 12 June 1994), p. 9.
4. Martin Van Crevald, Command in War, (Cambridge: Harvard University Press, 1985), p. 97.
5. Ibid. pp. 12-13.
6. AFSC Pub 2, p. II-5-B-1.
7. Ibid. p. II-5-D-1.
8. Department of the Army, Operations, FM 100-5, (Washington: 14 June 1993), p. 7-3.
9. AFSC Pub 2, pp. II-4-2, II-5-2.
10. Attributed.
11. AFSC Pub 2, p. II-5-A-1.
12. Van Crevald, Command in War, p. 264.
13. Ibid. p.270.
14. Ibid. p. 274.

BIBLIOGRAPHY

Armed Forces Staff College, AFSC Pub 2. Service Warfighting Philosophy and Synchronization of Joint Forces. August 1992.

Bowdish, Randall G. "The Revolution in Military Affairs: Giving Birth to the Sixth Generation." Scheduled for publication in the Summer 1995 edition of Parameters. U.S. Army War College, Carlisle Barracks, PA.

Department of the Army. Operations, FM 100-5. (Washington: 14 June 1993).

"Fleet Data Links Enhanced by New Architecture, Gear." Signal. November 1992. pp. 32-34.

Howard, Patricia L. "Copernicus: Shifting the Center of the Universe." Sea Power. February 1992. pp. 19-20.

The Joint Staff, Command, Control, Communications and Computer Systems, J-6. "Committed, Focused, and Needed," C⁴I for the Warrior. (Washington: 12 June 1994).

Krepinevich, Andrew F. Jr. "Keeping Pace with the Military-Technical Revolution." Issues in Science and Technology. Summer 1994. pp. 24-31.

Lum, Zachary A. "The Path to Heightened Awareness." Journal of Electronic Defense. September 1993. pp. 43-48.

_____. "My Brother's Keeper: Technology Tackles Fratricide Prevention." Journal of Electronic Defense. August 1993. pp. 48-51.

Lynch, David J. "Spacepower Comes to the Squadron." Air Force Magazine. September 1994. pp. 66-70.

McKenzie, Kenneth F. Jr. "Elegant Irrelevance: Fourth Generation Warfare." Parameters. Autumn 1993. pp. 51-60.

Slipchenko, Vladimir I. "A Russian Analysis of Warfare Leading to the Sixth Generation." Field Artillery. October 1993. pp. 38-41.

Sullivan, Gordon R. "Moving into the 21st Century: America's Army and Modernization." Military Review. July 1993. pp. 2-11.

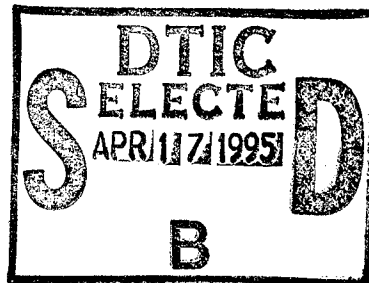
Toffler, Alvin and Heidi. War and Anti-War: Survival at the Dawn of the 21st Century. (New York: Little Brown & Company, 1993).

Van Crevald, Martin. Command in War. (Cambridge: Harvard University Press, 1985).

Wolf, James R. "Implications of Space-Based Observation." Military Review. April 1994, p. 75-85.

REPORT DOCUMENTATION PAGE

1. Report Security Classification: Unclassified			
2. Security Classification Authority: N/A			
3. Declassification/Downgrading Schedule: N/A			
4. Distribution/Availability of Report: DISTRIBUTION STATEMENT A: APPROVED FOR PUBLIC RELEASE; DISTRIBUTION IS UNLIMITED.			
5. Name of Performing Organization: Joint Military Operations Department			
6. Office Symbol: 1C		7. Address: Naval War College, 686 Cushing Rd., Newport, RI 02841-5010	
8. Title: A Theater-Level Integrated Sensor-to-Shooter Capability and Its Operational Implications (U)			
9. Personal Authors: Lieutenant Commander Randall G. Bowdish, USN			
10. Type of Report: Final		11. Date of Report: 08 March 1995	
12. Page Count: 18			
13. Supplementary Notation: A paper submitted to the Faculty of the Naval War College in partial satisfaction of the requirements of the Joint Military Operations Department. The contents of this paper reflect my own personal views and are not necessarily endorsed by the Naval War College or the Department of the Navy.			
14. Ten key words that relate to your paper: Theater-Level, Integrated, Sensor-to-Shooter, Operational Art, Revolution in Military Affairs, Operational Implications			
15. Abstract: Current military technological trends clearly point to an unprecedented theater-level integrated sensor-to-shooter (TLISTS) capability that will soon seamlessly bind all branches of the Armed Forces, achieving a synergistic capability greater than the sum of their parts. This TLISTS capability is described, followed by its operational implications in the areas of operational reconnaissance and intelligence, operational fires, tempo and synchronization. Command and control (C2) and doctrinal issues are also explored. The operational implications suggest that a TLISTS capability will enhance the operational commander's ability to craft operational art.			
16. Distribution / Availability of Abstract: Unlimited	Unclassified	Same As Rpt	DTIC Users
18. Abstract Security Classification: Unclassified			
19. Name of Responsible Individual: Chairman, Joint Military Operations Department			
20. Telephone: (401) 841-3414/4120		21. Office Symbol: 1C	



UNCLASSIFIED